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## Body mass index category and depression severity in patients attending the nutrition consultant clinic at Baghdad teaching hospital

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### Abstract

**Background:** The complex relationship between depression and obesity is well-documented, but the nuances across different weight categories remain unclear. This study investigates the prevalence and severity of depression across Body Mass Index (BMI) categories in a sample of patients attending a nutritional outpatient clinic in Baghdad, Iraq.

**Methods:** A cross-sectional design recruited 265 patients through convenience sampling. Socio-demographic and health characteristics data were collected through questionnaires. BMI was calculated from height and weight measurements. Depression severity was evaluated using the Patient Health Questionnaire-9 (PHQ-9). Descriptive statistics, chi-square tests, and logistic regression analyses were used to examine associations between BMI, depression severity, and other potential risk factors.

**Results:** The sample exhibited a high prevalence of obesity (70.7%) and concerning levels of depression, with nearly half (49.6%) experiencing mild depression and a significant proportion (28.9%) with moderate depression. A positive correlation between increasing BMI and depression severity was observed. Individuals with normal BMI had the lowest prevalence of depression, while those with severe obesity (class II & III) had the highest. Logistic regression revealed that higher socioeconomic status, higher education level, and the presence of comorbidities were associated with a higher BMI. Interestingly, depression severity was also a significant predictor of high BMI, highlighting the potential bidirectional link.

**Conclusion:** This study underscores the significant burden of obesity and depression in this patient population. The findings suggest a link between increasing BMI and depression severity. Further research is needed to explore the direction of causality and develop targeted interventions for weight management and mental health in this context.

**Keywords:** Obesity, depression, risk factors, comorbidity, and Baghdad

### Introduction

Depression is a prevalent and debilitating mental health disorder characterized by persistent low mood, loss of interest or pleasure in activities once enjoyed, and changes in sleep or appetite. It has significant personal and societal costs, impacting an individual's well-being, productivity, and healthcare utilization [1]. Studies suggest a complex bidirectional relationship between depression and obesity. While depression can lead to weight gain through unhealthy coping mechanisms like overeating, obesity itself has also been identified as a risk factor for the development and severity of depression [2, 3, 4].

This bidirectional link is likely due to several interconnected factors. Biological mechanisms involve changes in neurotransmitter activity, hypothalamic-pituitary-adrenal axis dysfunction, and inflammatory processes common to both depression and obesity [5]. Additionally, psychosocial factors like social stigma, body image dissatisfaction, and reduced physical activity associated with obesity can contribute to depressive symptoms [6, 7]. Understanding the association between different categories of BMI (underweight, normal weight, overweight, and obese) and depression severity is crucial in addressing this complex public health issue.

The prevalence of both depression and obesity is rising globally, with significant regional variations [8].

The Iraq Mental Health Survey in 2006-2007 estimated the prevalence of depression to be around 11.5% in the general population<sup>[9]</sup>, potentially even higher among individuals with health conditions requiring specialized care. Similarly, obesity is a growing concern in Iraq, with studies reporting a prevalence exceeding 30% in adults<sup>[10, 11]</sup>. While the association between obesity and depression has been explored internationally, limited research specifically investigates this link in the Iraqi population. Understanding this relationship within the local context is essential for developing culturally appropriate prevention and treatment strategies.

Existing research on the obesity-depression association often focuses on generalized obesity (BMI  $\geq$  30). However, exploring the association across different BMI categories (underweight, normal weight, overweight, and obese) can provide a more nuanced understanding of the relationship's progression. This study aims to address this gap by investigating the prevalence of depression and its severity across these BMI categories in a sample of patients attending the Nutritional Outpatient Clinic at Baghdad Teaching Hospital.

Furthermore, while the primary focus is on the association between BMI and depression, this research also acknowledges the potential influence of other factors. Comorbid medical conditions, socioeconomic status, and lifestyle habits can all potentially contribute to weight management difficulties. Examining these factors alongside BMI can provide a more comprehensive picture of potential risk factors in this specific patient population.

The findings of this study hold significant value for both the scientific community and the Iraqi healthcare system. By investigating the association between BMI categories and depression in this specific patient population, the study can contribute to an improved understanding of the obesity-depression relationship in the Iraqi context, identification of potential risk thresholds, and Development of a more comprehensive picture of obesity risk factors. Exploring the influence of additional factors alongside BMI can guide the development of holistic treatment plans addressing both mental health and weight management. Also, this research can be used by healthcare professionals working in nutritional clinics and primary care settings to improve screening and early intervention for depression in patients with varying weight statuses. Ultimately, this research aims to contribute to improved mental health outcomes for individuals struggling with both obesity and depression in Iraq.

### Objectives

1. To assess the prevalence of depression among patients across different BMI categories attending the Nutritional Outpatient Clinic at Baghdad Teaching Hospital.
2. To investigate the association between different BMI categories and the severity of depression symptoms in this patient population.
3. To investigate the association between BMI categories and other potential risk factors in this patient population.

### Subjects and Methods

**Study Design, Setting and Timing:** This study employed a cross-sectional design to investigate the association between

different BMI categories and depression severity among patients attending the Nutrition Consultant Clinic at Baghdad Teaching Hospital from March 2024 to May 2024.

**Study Population:** The study aimed to recruit a representative sample of patients attending the Nutrition Consultant Clinic at Baghdad Teaching Hospital. Inclusion criteria likely focused on capturing individuals seeking nutritional guidance, encompassing a range of ages and socioeconomic backgrounds. This ensured a broader understanding of the relationships between BMI and depression within this patient population. Exclusion criteria were likely in place to ensure participant safety and data quality. Patients with severe cognitive impairments or acute medical conditions that could interfere with data collection might have been excluded. Additionally, considering the focus on depression, individuals currently undergoing treatment with medications that could potentially influence mood or weight might have been excluded to isolate the specific effects of BMI on depression in this context.

**Sample size and technique:** A convenience sampling approach was used to recruit a total of 265 patients attending the clinics. Convenience sampling is a non-probabilistic method where readily available participants are selected. While acknowledging limitations in generalizability, it may be suitable for initial investigations. The authors aimed for a balanced sex distribution, which is a commendable effort to reduce potential gender bias.

**Data Collection Tools:** To gather comprehensive data on the study population, the researchers employed a multi-pronged approach. Participants completed a self-administered socio-demographic and health characteristic questionnaire. This questionnaire likely inquired about basic demographics like age, gender, marital status, education level, employment status, economic status, and residence location. It delved further into potential health risk factors by querying about family history of mental disorders and the presence of any co-morbid medical conditions. Additionally, standardized anthropometric measurements of height and weight were obtained, allowing for the calculation of BMI. Finally, the well-established Patient Health Questionnaire-9 (PHQ-9) was used to assess the severity of depressive symptoms among participants<sup>[12]</sup>. This multifaceted data collection strategy provided a rich picture of the participant's demographics, health backgrounds, and potential mental health concerns.

**Data Management and Analysis:** The study employed SPSS software to analyze data collected through questionnaires and anthropometric measurements. Descriptive statistics provided a snapshot of the population's demographics, health characteristics, and depression prevalence across different weight categories. Chi-square tests explored associations between high BMI and various factors like marital status or education. To delve deeper, logistic regression analysis examined the relationship between high BMI and depression severity, along with other potential risk factors, excluding confounding variables. Statistical significance was set at  $p < 0.05$ , ensuring results are less likely due to chance.

**Ethical Considerations:** The study prioritized ethical

principles by obtaining written informed consent from participants, guaranteeing their autonomy and comprehension of the research goals. Additionally, the researchers committed to upholding participant privacy throughout the study by ensuring anonymity and data confidentiality. These measures safeguard sensitive information and empower participants to make informed decisions about their involvement.

**Data Availability:** Due to ethical reasons and privacy concerns, individual participant data cannot be shared publicly. This ensures participant privacy and protects sensitive information.

**Results**

**Sample Characteristics**

Table 1 demonstrates a heterogeneous sample population

regarding demographics and socioeconomic factors. Age distribution skewed slightly towards the 40-49 year range (29.3%), with a near-even spread across other age groups. Gender distribution was nearly balanced, with a slight female majority (51.6%). Marital status was predominantly married (78.1%), with a smaller non-married group (19.9%). Notably, educational attainment showcased a strong representation of graduates (45.3%) and a significant portion with primary education (27.7%). The majority of participants were not currently working (53.1%), with a sizeable public employee sector (28.5%). Economic status leaned towards lower income (67.2%), with a smaller middle-income group (27.7%) and a very small high-income group (5.1%). Residence distribution was fairly even between urban (59.8%) and rural areas (40.2%). Interestingly, no participants reported a family history of mental disorders.

**Table 1:** Distribution of the socio-demographic data among study participants

Variables	256 (100.0)
<b>Age Group (Years)</b>	
20- 29	46 (18.0)
30- 39	43 (16.8)
40- 49	75 (29.3)
50- 59	62 (24.2)
60 +	30 (11.7)
<b>Sex</b>	
Male	124 (48.4)
Female	132 (51.6)
<b>Marital Status</b>	
Unmarried	51 (19.9)
Married	200 (78.1)
Separated & Widowed	5 (2.0)
<b>Education Level</b>	
Write & Read	23 (9.1)
Primary	71 (27.7)
Secondary	29 (11.3)
Graduate	116 (45.3)
Postgraduate	17 (6.6)
<b>Recent Job</b>	
Not Working	136 (53.1)
Public Employ	73 (28.5)
Private Employ	21 (8.2)
Retired	26 (10.2)
<b>Economic Status</b>	
Low	172 (67.2)
Medium	71 (27.7)
High	13 (5.1)
<b>Residence</b>	
Urban	153 (59.8)
Rural	103 (40.2)
<b>Family History of MDS</b>	
Yes	0 (0.0)
No	256 (100.0)

**Health Characteristics (Table 2):** A significant portion (37.1%) fell within the Obesity I category, with an additional 33.6% classified as Obesity II or higher, indicating a high prevalence of obesity. Physical activity levels were low, with 68% reporting a simple activity level and none reporting a high level. Dietary habits raised concerns, as a substantial number favored sweet or meat-based diets (56.2% combined) compared to fruits, vegetables, and legumes (32.4% combined). Comorbidity presence was also concerning, with hypertension being the

most prevalent (39.1%) followed by a combination of heart disease and hypertension (23.4%). Depression scores further highlighted potential health concerns, with nearly half (49.6%) of participants experiencing mild depression and a significant proportion (28.9%) exhibiting moderate depression. Overall, Table 2 paints a picture of a population with a high burden of obesity, low physical activity, potentially unhealthy dietary habits, and significant comorbidity and depression rates.

**Table 2:** Distribution of body mass index (BMI), physical activity level, favorite Diet, co-morbidities, and depression scores among study participants

Variables	256 (100.0)
<b>BMI</b>	
Under weight	13 (5.0)
Normal weight	14 (5.5)
overweight	48 (18.8)
Obesity I	95 (37.1)
Obesity II & more	86 (33.6)
<b>Physical activity levels</b>	
simple	174 (68.0)
moderate	82 (32.0)
high	0 (0.0)
<b>Favorite diet</b>	
sweet	96 (37.5)
meat & sweet	48 (18.7)
Meat & bird	47 (18.4)
fruit	30 (11.7)
vegetable	20 (7.8)
legumes	10 (3.9)
milk	5 (2.0)
<b>Co-morbidities</b>	
Hypertension	100 (39.1)
Heart disease & Hypertension	60 (23.4)
Eating disorder	37 (14.5)
Diabetes	25 (9.7)
DM & HT	10 (3.9)
Rheumatic disease	12 (4.7)
None	12 (4.7)
<b>PHQ9 (Depression Scores)</b>	
Normal	17 (6.7)
Mild depression	127 (49.6)
Moderate depression	74 (28.9)
Severe depression	38 (14.8)

**Association between BMI and Depression Severity (Table 3):** This table shows a significant association (p-value = 0.001) between high BMI and depression severity (measured by PHQ-9). Nearly half (49.6%) of participants screened positive for mild depression, with smaller but notable proportions experiencing moderate (28.9%) and severe depression (14.8%). Interestingly, while no participants in underweight (n=13) or normal weight categories screened positive for normal depression, 50% in

the underweight group did for severe depression (cautious interpretation due to small sample size). The distribution of depression severity becomes more even in the overweight group (29.7% moderate), and the obese categories (Obese I, II & III combined) show the highest proportions with depression (>70%), with substantial presence in both moderate and severe categories. This suggests a possible link between increasing BMI and a higher likelihood of depression.

**Table 3:** Association between different BMI categories and Depression Severity

Variables	PHQ9				Total 256 (100.0)	P-value
	Normally 17 (6.7)	Mild Depression 127 (49.6)	Moderate Depression 74 (28.9)	Severe Depression 38 (14.8)		
BMI	Under weight	0(0.0)	0(0.0)	0(0.0)	13(5.0)	0.001
	Normal weight	0(0.0)	10(7.9)	4(5.4)	14 (5.5)	
	Over weight	0(0.0)	23(18.1)	22(29.7)	48 (18.8)	
	Obese I	13(76.5)	53(41.7)	23(31.1)	95 (37.1)	
	Obese II & III	4(23.5)	41(32.3)	25(33.8)	86 (33.6)	

**Association between BMI and Other Factors:** Chi-square analysis revealed significant associations (p-value <0.05) between BMI and various factors. Younger age groups skewed towards overweight, while older adults had a higher prevalence of obesity. Interestingly, females exhibited a higher proportion of obesity class II and III compared to males. Additionally, significant associations were found between BMI distribution and marital status (married), education level (high), economic status (high), urban residence, and the presence of comorbidities. Notably,

unemployed and retired individuals had a significantly lower prevalence of overweight and obesity compared to employed individuals. Similarly, individuals with higher education, higher economic status, and residing in urban areas had a greater likelihood of being overweight or obese. Furthermore, the data suggests a potential link between dietary habits and physical activity with weight status. A preference for fruits and higher physical activity levels were associated with a healthier weight range.

**Un-confounder risk factors of High BMI (Table 4):** Logistic regression analysis explored the association of high BMI with various independent risk factors in Table 3. The results highlight several significant relationships. Individuals with higher socioeconomic status (OR: 0.500) and high education level (OR: 0.251) were surprisingly more likely to have a high BMI compared to their counterparts. This could be due to factors like easier access to processed foods or less physically demanding jobs in higher socioeconomic groups. Additionally, the presence of comorbidities (OR: 0.045) emerged as a strong predictor of a high BMI, suggesting a complex interplay between chronic health conditions and weight management. Gender also played a role, with females (OR: 0.353) having a significantly higher risk of having a high BMI compared to males. The residence location (urban) presented a curious

finding. While the odds ratio (0.314) suggests a possible association with a higher risk.

One intriguing finding is the significant association between depression severity and increasing BMI. Individuals with higher scores on the PHQ-9, indicating greater depression, have a substantially higher risk of having a high BMI (OR: 0.215). This correlation could be attributed to factors like changes in appetite or decreased physical activity levels often associated with depression. It's crucial to note, however, that the direction of causality remains unclear. Depression might lead to weight gain, but weight struggles could also contribute to the development of depression. Additionally, the study found that a dietary preference for meat, bread, and sweets (OR: 0.011) was strongly linked to a higher risk of high BMI.

**Table 4:** Logistic regression analysis for association of various risk factors with BMI

Variable	Odd's ratio	95% C.I for odd's ratio	P-Value
High economic status	0.500	0.217 - 0.786	0.004
Female	0.353	0.051 - 0.713	0.047
Urban residence	0.314	0.014 - 0.605	0.035
High education level	0.251	0.092 - 0.411	0.004
Depression by PHQ9	0.215	0.003 - 0.420	0.047
Co-morbidities	0.045	0.018 - 0.069	0.004
Dietary habits (meat, bread, sweets)	0.011	0.004 - 0.018	0.008

## Discussion

This study investigated the association between increasing BMI and depression severity in a sample of patients attending the Nutrition Consultant Clinic at Baghdad Teaching Hospital. The findings highlight a concerning prevalence of both obesity and depression in this patient population, with a positive correlation between increasing BMI and depression severity. Discuss these findings in the context of similar recent studies, exploring areas of convergence and divergence.

**High Obesity Prevalence:** The current study is consistent with existing research demonstrating a global rise in obesity prevalence<sup>[10, 11]</sup>. The observed rate of 70.7% obesity in the study population is comparable to findings from other Middle Eastern countries like Saudi Arabia (overweight/obesity near 56%)<sup>[13]</sup> and Kuwait (overweight/obesity near 77%)<sup>[14]</sup>, suggesting a regional trend.

**Obesity-Depression Link:** The positive correlation between increasing BMI and depression severity observed in this study echoes findings from numerous recent studies. A 2017 meta-analysis by Wilson *et al.*<sup>[15]</sup> found a significant association between obesity and depression, with a dose-response relationship, meaning depression risk increased with higher BMI categories. Similarly, a 2022 study by Wang *et al.*<sup>[16]</sup> in the United States reported a higher prevalence of depression in obese individuals compared to normal-weight individuals.

**Socioeconomic Disparities:** The study's finding that higher socioeconomic status (SES) and education were associated with a higher risk of high BMI aligns with some recent research. However, it's important to note that other studies report conflicting findings. A 2021 study by Zhao *et al.*<sup>[17]</sup> in China found an inverse association between education

level and obesity in urban residents. While study by Anekwe *et al.*<sup>[18]</sup> in the United States found a positive association between SES and obesity prevalence. This suggests potential regional variations and the need for further exploration of the complex interplay between SES and weight management.

**Gender Differences:** The finding of a higher risk of high BMI among females aligns with some recent studies. Indian survey in 2017-18 reported a higher prevalence of obesity in women compared to men<sup>[19]</sup>. However, biological and cultural factors influencing gender and weight can vary significantly across regions.

**Depression Severity:** While the current study highlights a high prevalence of depression, particularly mild and moderate depression, recent studies report varying levels of depression severity in obese populations. A 2023 study by Kraus *et al.*<sup>[20]</sup> in the European Group found a higher prevalence of major depressive disorder in obese individuals compared to the current study's findings. This difference could be attributed to variations in sample characteristics, depression assessment tools, or regional mental health trends.

**Comorbidity:** The current study identifies the presence of comorbidities as a significant predictor of high BMI. This aligns with findings from a study by Liu N *et al.*<sup>[21]</sup> in the United States, which reported a bidirectional relationship between obesity and chronic diseases. However, further research is needed to explore the specific mechanisms underlying this association.

**Dietary Habits and Physical Activity:** While the current study suggests a potential link between dietary habits and physical activity with weight status, the specific dietary patterns associated with obesity are not deeply explored.

Recent studies delve deeper into dietary patterns. A 2021 study by Benaich *et al.* [22] identified a higher consumption of processed foods and sugary drinks as risk factors for obesity. Similarly, a 2023 study by Raiman *et al.* [22, 23] in Croatia found a positive association between low physical activity levels and obesity. Future studies in Iraq could benefit from a more detailed examination of dietary patterns and physical activity levels concerning BMI.

**Limitations and Future Directions:** This study acknowledges its limitations, including the use of a convenience sample and the cross-sectional design, which precludes establishing causality. Future research in Iraq could benefit for addressing these limitations and incorporating insights from recent studies, and contribute to a more comprehensive understanding of the obesity-depression relationship in Iraq. This knowledge can inform the development of culturally appropriate interventions for weight management and mental health promotion in this region.

### Conclusion and Recommendation

This study revealed a high burden of obesity (over 70%) and depression (nearly half with symptoms). A positive correlation between high BMI categories and depression severity suggests a potential two-way influence. Interestingly, factors like higher socioeconomic status, higher education level, female sex, dietary habits (meat, bread, and sweets), co-morbidities, and urban residence were linked to increased obesity risk, while depression severity itself was also a predictor. Limited by convenience sampling and a static design, these findings highlight the need for further research. Longitudinal studies with broader samples are crucial to understand cause and effect. Additionally, detailed dietary assessments, exploring cultural influences on weight perception and mental health, along with a biopsychosocial approach, are necessary for a more nuanced understanding of the Iraqi context. By addressing these limitations and incorporating recent research, future studies can inform culturally appropriate interventions for weight management, mental health promotion, and improved depression screening across the weight spectrum. This knowledge can ultimately lead to better mental health outcomes for Iraqis struggling with both obesity and depression.

### Author's contributions

The study was a collaborative effort with Dr. Mohsin Ahmed Jasim and Dr. Riyadh Shiltagh Al-Rudaini leading data collection and study implementation, while Dr. Zainab Ghassan Lutfi and Dr. Rana Faeq Saud focused on data analysis and manuscript preparation. All authors then critically reviewed the report and provided final approval for the current version.

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### Conflict of interest

The authors declare that there is no conflict of interest in the publication of this article.

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